

## The determinants of technical progress in Celso Furtado

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**ABSTRACT:** This paper aim is to discuss the differences of the technical progress determinants, therefore, productivity and economic growth in Celso Furtado's work. It is focused two major books, the first one is *Desenvolvimento e Subdesenvolvimento (Development and underdevelopment)* from 1961, and the second book is *Criatividade e dependência na civilização industrial (Creativity and dependency in the industrial civilization)* from 1978. The hypothesis adopted in this project is that there are differences in the Furtado's interpretation related to technical progress determinants in those two books. In order to achieve the goals of this work, it is studied the books already mentioned and also other works from Furtado that can be useful to understand the determinants of technology and productivity. This paper importance relies on the fact that there are differences of the determinants of technology in different phases of the author intellectual work.

Keywords: Celso Furtado, Keynesian theory, creativity, technical progress, innovation.

**RESUMO:** O objetivo desse trabalho é analisar as diferentes interpretações e definições da tecnologia em diferentes trabalhos de Celso Furtado, com foco em dois livros, o primeiro *Desenvolvimento e subdesenvolvimento* de 1961 e o segundo livro *Criatividade e dependência na civilização industrial* de 1978. A hipótese adotada é que existem diferenças na concepção do autor em relação à tecnologia nos dois livros. Para cumprir o objetivo desse trabalho, será necessário estudar os textos do autor dentro do contexto do debate em que o mesmo estava envolvido, e relacionar os textos desse autor com outros textos produzidos dentro do mesmo contexto. Esse trabalho se justifica pela importância de entender qual a concepção sobre tecnologia dentro de parte da obra de Celso Furtado, a fim de demarcar conceitualmente as diferenças no conceito de tecnologia utilizado por Furtado.

Palavras-chave: Celso Furtado. Teoria Keynesiana, Criatividade, Progresso técnico, inovação

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### 1- Introduction

Celso Furtado lived in Brazil between 1920 and 2004. He is one of the most renowned Brazilian economists, and author of a vast work on economics. The author wrote mainly on the topic of economic development. About this subject, he wrote many papers as well as books. Furtado increased knowledge development economy, by creating his own category, the "underdevelopment". This author wrote about various topics, and he was pioneered in many others: for instance, he is one of the founders and the main representative of what became known as Latin American structuralism.

In the book *Formação Econômica do Brasil* from 1959 (Brazil Economic Formation), the author presents his historical-structural method. He shows in this study that despite of changes in the economic cycles in Brazil during the colonization period, its structure reproduced the social inequality. In this book the author describes the view that the profits are privatized but the losses are shared. During the time in which Furtado writes this book, he was visiting the University of Cambridge.

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Returning to Brazil, the author worked on public administration, as director at the *Banco Nacional de Desenvolvimento* (BNDE, Brazilian Development Bank), and become first Economic Planning Minister. During the same period, he wrote one of the works analyzed in this paper, *Desenvolvimento e Subdesenvolvimento* (Development and Underdevelopment), from 1961. In this book, besides using the historical-structural method, the author begins to study the underdevelopment phenomenon, advancing the knowledge regarding to development theorists such as Rostow (1969), Rosentain-Rodan (1969), Hirschman (1961), Nurkse (1969), Myrdal (1986) e Lewis (1969).

In the 1961 Furtado's book is important to understand the technological progress determinants. It is worth observing that by studying Schumpeter he emphasizes the issue of monopoly, in this sense, the innovation process is the result of the monopoly process, which means that innovation is not the main driver of technical progress. To Furtado, Schumpeter is in the category of theorists who study the entrepreneur's role in capitalist dynamics.. However, Furtado, when analysing the Keynesian theory, stresses the incorporation idea of technology from the core countries. He calls attention to the Keynesian (Harrod-Domar's model) notion that in order to increase investment, and hence the technical progress in the economic system, is required increase domestic savings.

It is argued later in this paper that Furtado changes his opinion about the determinant of technical progress. On this matter, in the book *Criatividade e dependência na civilização industrial*, (Creativity and dependence in the industrial civilization) from 1978, creativity is responsible for generating innovations, then innovation generates technical progress, and consequently economic growth.

Holding positions in public administration in Brazil, Furtado experienced a sudden and abrupt change in his career. With the military coup in 1964, he had his civil rights suspended for ten years. He was then invited to work in three different US universities - Yale, Harvard and Columbia. After a brief passage from Yale University, he becomes, in 1965, Professor of Economic Development at the Faculty of Law and Economics of the University of Paris (Sorbonne), where he worked for the next twenty years (CUNHA & BRITTO, 2011).

In this period, Furtado wrote his 1978 book and taken in its context, it reflects three different matters: i) the Marxist criticism made by Fernando Henrique Cardoso and Enzo Faletto to theories of underdevelopment; ii) the intellectual context where Furtado was immersed, namely, University of Paris; and iii) the issue of dictatorship in Latin America as one of the criticisms that Furtado presents in his 1978 work is that the lack of freedom is a constraint of creativity. In this book, innovation is related to creativity, which leads to technical progress. Thus, it is argued that Furtado changes his opinion about the technical progress causes.

Apart from the introduction and conclusion, this paper has three more sections. In the second section it is discussed the 1961's book, in which Furtado studied the technical progress issue on economic classical authors, besides Keynes and Schumpeter. In the third section, it is analyzed how Furtado sees the technical progress determinants. In the fourth section, it is examined the determinants of technical progress in the 1978' book.

## **2- Technical progress and Classical economists**

In this section it is discussed the first chapter of the book "Development and Underdevelopment". The aim is to verify Furtado's criticisms on classic authors of economic thought, besides Keynes and Schumpeter. This study will provide to understand the author's

interpretation of the determinants of technological progress, consequently, productivity and economic growth. The 1961 book "Development and underdevelopment" was one of the first attempts to understand the problems faced by underdevelopment countries. Furtado (1967) defines economic development as the process that the labor productivity increases constantly.

In the first chapter of the mentioned book, the author attempts to understand the relationship between the technology, productivity and development. This study covers several other authors such as Adam Smith, David Ricardo, Karl Marx, Alfred Marshall, Joseph Schumpeter among others.

From the classical ideas, Furtado (1961) observes some differences between the enterprises productivity and the social productivity. From the classical ideas, he made several criticisms about the importance of the technology, productivity and development. To Furtado, it would be a mistake to understand the general productivity system from the firm's point of view, thus even that the firm productivity increases, it does not mean that the productivity of the whole system would increase as well. For the classical economists, the social productivity is the total production per unit of work (in time). Therefore, the idea of development is linked to the macroeconomic system.

Furtado (1961) criticizes Adam Smith arguing that the classical economists have not explained the reason of the development. For Adam Smith, the increase in productivity is due to work division, in this sense the division will be possible if the market is large enough. However, the market size depends on productivity growth.

In Ricardo and Malthus, Furtado observes that the idea of productivity is related to land income. If the population increases the land income increases as well, this causes a positive impact on capital accumulation, wage and consumption. Thereby, the medium labour productivity may decrease in the same time that the land rent increases.

The technological progress theory for J.S. Mill is a stationary theory. In other words, the capital accumulation is the main factor of productivity increases. In this way, the capitalists increase productivity because they are trying to defend their profit margin from the wages growth (FURTADO, 1961; 1967). Furtado (1961) argues that the classical economists have a lack of theory about development. The development would be achieved from the process of capital accumulation and technical progress. In the 1967 work, Furtado studied the classical economists, however, in this book, at least when he is discussing Ricardo, he focuses on the issue about the productivity related to the functional distribution of the income.

Furtado (1961; 1967) argues that there is a logical problem in the Marx' theory. The work division increases the productivity, as it has already been pointed out by Smith. However, Marx part from the idea that the total production is the social liquid product sum in addition to surplus value. In this way, due to surplus value, there is a concentration tendency of capital accumulation. Thus, saving is the result of unpaid labour. Nevertheless, Furtado argues that the savings are important to increase productivity. More than that, in 1961's book he says that without savings it is not possible to increase productivity. The logical contradiction, one on hand, Furtado argues it is because in Marx' theory the constant capital increases faster than population, therefore, there is a tendency of raising wage share in the social product. On the other hand, there is the labour industrial reserve that presses the wages down. Furtado points out that it is not possible to use those two ideas (the tendency of growth in the wages versus the idea of industrial reserve army).

Furtado (1961), in his studies about the neoclassical theory, the author argues that neoclassical theory is a stagnation theory, because if the economy tends to achieve the equilibrium, there is no place for development. In the neoclassical theory, the productivity is related to equilibrium between supply and demand.

Furtado (1961) discussed the “entrepreneur theory”. He studied some economists that emphasises the entrepreneur importance for the development process. Among this authors, he included Schumpeter and Wicksell. For the purpose of this paper, it is focused on his studies about Schumpeter. Furtado observes that the innovation is different from the productivity in Schumpeter. He understand Schumpeter’s ideas as a profit theory. The entrepreneur increases the capital investment and therefore the profit. In this case, the profit increases following the increasing in the monopoly situation. Thus the productivity is a result of capital accumulation. In his words:

“The concept of 'new combinations' or 'innovation' is not clear. The creation of monopoly is considered by him [Schumpeter] as a 'new combination'. It is not, therefore, a concept necessarily involving the idea of increased productivity, cost for reducing a technological innovation, etc.. It is something broader and which the only constant element seems to be the ability to create a privileged situation - even momentarily for a business, which would result in the formation of profit. Such idea would lead us very far because there are thousands of factors that create situations privileged to a businessman and that has nothing to do with development, because almost always bring in return an opposite situation to another employer” (FURTADO, 1961, p. 72) [free translation]

Furtado argues that innovation in Schumpeter's theory is not a theory about innovation, but a theory about organization or a new production enforces combination. Therefore, what matters is the monopoly that emerges from a new way of organizing production.

Furtado (1961;1967), in his studies related to Keynes’ theory, the author discusses a few aspects of it. Furtado agrees with Keynes’s ideas related to neoclassical theory, explaining without details the conception of aggregate demand. To Furtado, Keynesian theory is about the capital accumulation. Furtado considers Keynes ideas as part of theories about economic fluctuation and countercyclical economic policy. Moreover, if the capacity utilization level is high, it is due to high level of investment. Furtado argues that the Keynes simplified his model, since that in Keynes theory the level of investment is determinate by the marginal capital efficiency and interest rate. In Furtado model, it is highlighted the technical progress idea in order to explains the labour and capital increases.

In Furtado 1967’s work, there is a detailed explanation related to Harrod’s model. It is considered in the present paper that Harrod’s model was the main inspiration for Furtado models of underdevelopment and development economies, or, at least it is the first Furtado’s work where he made Harrod’s model explicated.

In Keynes model, the investment creates income and also increases the installed capacity. Nevertheless, the income magnitude and installed capacity creation depends on economy structure, and this structure is related to i) the consumption function, and ii) the Keynesian multiplier. It is important to highlight that the level of installed capacity determines the income level and employment. Moreover, in a full employment scenario, investment increase will increase savings, due to the income multiplier effect. In this case, the consumption may decrease.

Furtado (1967) argues that Keynes idea could be applied to the short run, however, not in the long run. Although as argued by Kregel (1976) and Dutt (1997), Keynes model is a dynamic long run model. Because Furtado views the Keynesian model as a short term model, the author indicates the Harrod-Domar's model as a solution, considering it is a dynamic model.

Harrod' model claims that capital accumulation is possible because the industry tries to adjust the stock level to demand all the time. The necessary growth rate for the production is the same as the relation product-capital. In this model, the accumulation rate depends on the proportion of the product that is saving and the relation between product and capital ( $Y/K$ ). The main model result is that the product growth rate is related to the technical progress growth and population growth. However, the new technologies created by this growth process may create unemployment.

Furtado (1967) criticizes and suggests a modification in Harrod' model. He considers the investment in both past and present periods. With this modification, the income distribution is introduced in the model. Thus, the equilibrium is achieved when the investment is sufficient to absorb the natural population growth and the underdevelopment created by the new technologies.

In this section was discussed Furtado view about the classical economists, Schumpeter and Keynes. The author criticizes the classical economists for not finding in those theories the discussion about economic development; also he criticizes the Keynesian approach, and proposes some modifications. With the proposed changes, the distribution of income becomes important.

### **3- Technical progress into Desenvolvimento e Subdesenvolvimento**

The historical context in which Furtado develops his ideas about development and underdevelopment economies is connected to the historical process where the author was immersed. Until 1940, historical moment marked by the World War II, the economic theories were searching for ways to explain the capitalist system periphery, such as Latin America countries (MALLORQUIN, 2005).

Furtado theoretical formation was based on law and the administration. Around 1945, he decided to graduate as a PhD from Law school at the University of Paris, where he met professors linked to economics, such as François Perronx and Maurice Bye. Furtado then starts his studies on Brazilian colonial economy, when he acquired economic issues knowledge, especially approaches about historical research methodology (MALLORQUIN, 2005).

In one of Furtado first research on economics were based on conventional economic theory. Nevertheless, there were innovative elements in this work. For instance he discuss in the 1950 article (*A economia brasileira*. RJ, A Noite, 1954 [The Brazilian economy]) the lost socialization process and this theme will appears again in other Furtado works (MALLORQUIN, 2005).

Still around 1950, he established himself at the United Nations, working for the ECLAC (Economic Commission for Latin America and the Caribbean). Furtado worked at

ECLAC from 1949 to 1957, where he held a variety of positions, including director of the Economic Development Division, he also published several papers in this period. At this time Furtado wrote the book *Development and Underdevelopment*. He returned to Brazil, following a period at the University of Cambridge (UK), 1957-58. On returning to Brazil, during 1958-1964 he held positions in public administration and became director of the *Seção Nordeste do Banco Nacional de Desenvolvimento Econômico* [Northeast Section of the National Bank for Economic Development], and then superintendent at Superintendence for the Development of the Northeast (SUDENE in Portuguese), he also was promoted to Prime Minister of Planning (MALLORQUIN, 2005).

In his time working in public administration, the author attempts to put into practice his knowledge about economics, which he reflects on the matter of underdevelopment, and the problems related to the issue of technology and productivity. More specifically between 1955-62, Furtado would be the head of the commission ECLA / BNDE, responsible for developing studies to support the economic development program in Brazil. In 1958 he is promoted as the head of Superintendence for the Development of the Northeast (SUDENE in Portuguese), which worked for the development of the northeast region (MALLORQUIN, 2005; CUNHA & BRITTO, 2011).

The discussion about technical progress is related to the issue of development. First, it is important to highlight that anti-cyclical policies are different from policies that have as objective the economy's development. Secondly, the idea of development for Furtado, at least in the period before the 1976's book, has relationship with capital accumulation. It is argued in the present paper that the capital accumulation idea that Furtado holds is based on Harrod-Domar model.

Furtado in the 1961's book, for the first time he presents the Harrod-Domar model in a systematic form. It happened as the result of Furtado new work. He became a professor of development at the University in Paris. In this book, Furtado wrote:

“The development process takes place through new combination of factors in the existing technical level, known either by technical innovations.” (FURTADO, 1961, p85)

In this sense, development has relationship with the combination of the production factor, or through technical innovation. Furtado argues that the medium productivity of the production factors is smaller in an underdevelopment economy if compared with a development economy.

“At first, Furtado works with a concept of development similar to that found in other works from the pioneers of economic development, as well as to that from ECLA. Initially, development is equated with productivity gains associated with capital accumulation and the incorporation of new technologies of production. Hence, the process of development takes place through the combination of existing factors of production, given a technology, or through new technologies.” (CUNHA & BRITTO, 2011, p.13).

To Furtado, at least in the 1961's book, the physical productivity or labour productivity came from the capital accumulation. Nevertheless in underdevelopment economies, there is not an endogenous capital accumulation core, which means that the capital (machines) is imported. As consequences of the importation of capital, the structural under-employed labour, due to the economy is using advanced technology.

“Furtado’s historical-structural analytical method renders what would be an otherwise standard definition for the period, a much richer view about underdevelopment and the process of development itself. Given that the new production techniques are in reality introduced on pre-existing economic structures, the main task of development theory becomes the analysis of the impacts the introduction of new methods of production brings up, its repercussions in terms of productivity gains, distributive patterns and use of the social output.” (CUNHA & BRITTO, 2011, p.13)

Yet in 1961’s book, the author elaborates the concept of technological inadequacy. Albuquerque (2007) identifies this concept in three major Furtado’ books. Technological inadequacy means that the periphery countries have to make a huge effort for the assimilation of known techniques from the central countries. Moreover, ‘To the extent that the consumption patterns of the minority match the patterns in countries leaders in technological progress and that have a high level of capital accumulation, any attempt to adapt technology will be rejected’ (1987, p. 211). Furtado argues that the development process consists on introduction of new combination of production factors that increase the productivity of the work force.

The combination of low productivity with income concentration implies that almost all population remains outside the exchange economy. However different capital and labour combinations, especially those that increase the capital levels, carry technological innovations, it would enhance economic productivity. It is possible to see from the idea just presented, the Harrod-Domar model behind the framework of different capital and labour combinations, hence economic growth.

Furtado also discusses the developing economies possibility using external push. For this external impulse be favourable to the economic development, it should not be accompanied by income concentration. Since this impulse increases productivity, with positive impacts on domestic income, it will diversify the demand, generating pressure on prices, which enhance investment opportunities.

“In this way, the new savings will be absorbed either in investment supported in external demand, as others related to internal market. The new investment will seek to increase productivity in other sectors and will repeat the reactions pointed above.” (FURTADO, 1961,p.90)

In case the income concentration, increase in income generated by the external resource will not generate demand diversification. In addition, if the saving level are low, the investments also will be low, which reduces the possibility of development. The idea that investment growth depends on the level of savings is compatible with the Harrod-Domar model. The capitalization rate is the proportion of current income. This is transformed in new production capacity. Again, Furtado argue that it is necessary to increase savings to have a positive impact on investment.

“The capitalization rate translates the degree of effort that an economy makes, in a given period of time, to grow. It defines the part of the obtained product in this period of time that the population ceases to consume to transform into productive capacity” (FURTADO, 1961, p 96)

Furtado in the 1961’s book claims that economies with low productivity and income concentration makes the majority of the population to have subsistence consumption, thus the savings level will be low, because it reduces the level of investment. More intense capital

accumulation is related to increase in technical progress. Raising capital stock opens the path for scale economies and external differentiation created by the productive structure, which becomes itself into a factor of productivity increase.

Furtado mentions innovation and invention. However, he argues that innovation accelerates accumulation process. This accumulation process is made by increasing the portion of income not consumed. Also, the author argues that with the production growth, it presses rising in wages. To maintain the income share, entrepreneurs will search for innovations, in order to reduce labour costs.

This section showed that in the 1961's book, Furtado theory was based in Harrod-Domar model. In this sense, there is the idea that savings precede investment. And in this book has little space for innovation.

#### **4- Creativity, innovation and technical progress**

The context in which the book *Criatividade e Dependência na Civilização Industrial*, 1978 [Creativity and Dependence in Industrial Civilization] was written is related with some events: i) Furtado was answering an important criticism made by Structuralisms/Marxists authors; ii) the intellectual context where the author was involved; and iii) the notion that lack of freedom could constrain creativity can be related to the fact that countries in the Latin America were under dictatorships.

Between 1966 and 1989, Furtado was an associate professor at University of Paris and director of Advanced Studies Institute of Latin America, at the same university. In this period, he wrote around 15 books, including the 1978's book. In this last mentioned work, Furtado changed his opinion on subjects such as technology and productivity. In this work, creativity generates innovation, and innovation is a key driver to capital accumulation, which is different from what he wrote on capital accumulation in the previous works, where the capital accumulation key was the increase in the saving rate in the economy.

Albuquerque (2013) argues that the innovation process in the 1978 Furtado's book is seen as a process of multiple meanings that surpasses the notion of technological progress. Innovation in the sense proposed by Furtado is directly related to human creativity. Creativity in context of the book leads to the innovation. However, what is in the focus of the book is how creativity has made possible the existence of developed countries, and how might be the path to overcome underdevelopment. Thus, creativity / innovation are the key factor to increase technological and therefore productivity in the economic system.

Mallorquin (2005) argues that the book *Creativity and Dependence in Industrial Civilization* was the one that Furtado had prided and appreciated the most. This book, according to Mallorquin (2005) takes universal economic history approach by using a speculative and philosophical written form and history concepts. The major characters of this book are transnational enterprises and developing countries. In this sense, the work is about effort broken by developing countries for modernization and adaptation from large industrial centres.

Furtado in 1978's book discuss his theory based on authors such as Weber, Nietzsche, Marx and so on. The book shows a wide variety of concepts and ideas. He manages to overcome current theories by creating a "big theory" that totalize the historical process of the emergency and development of industrial society, showing how developing countries have been inserted in the industrial process indirectly, and thereby reproduced underdevelopment.

Authoritarianism may represent the blockage to creativity, which contributes to the reproduction of underdevelopment (MALLORQUIN, 2005). Albuquerque (2013) comments it uses the idea of Nietzsche in the sense that lack of freedom could block creativity.

Albuquerque (2013) interprets that human creativity is the guiding theme of the book's structure. Thus, it is the driving force of the innovation process and invention. Nevertheless, in this interpretation, the industrial civilization constrains and limits the creativity.

Furtado, when the book was written, was a professor of economic development at University of Paris. Thus, the intellectual context which he was involved is important to explain the way the book was written, and his attempt to create a "big theory".

On this point, it is worth underlining the hypothesis proposed by Cunha and Britto (2012). These authors consider that Furtado was discussing with Perroux. They observe that Perroux began to work with the creativity issue in the 1960s, and that later in the 1970s Perroux had produced the idea that human creativity would be the main driving force behind innovation. In addition, Perroux was discussing the alienation matter in the industrial society, which Furtado also discusses in the 1978' book.

“It is from the fifth chapter onwards, that Furtado is pondering on the future and the possibilities to transform the current reality. This is done in an analytical style that I compare to “*virtualités*” and that, as well as Perroux, decidedly qualifies as an attitude of a realistic utopia. Creativity becomes the key word from this part onwards, and the argument threads its way into the next chapter (Dependence in a unified world), in which interrelation between cultural dependence and technological dependence is made clear.”(CUNHA & BRITTO, 2012, p. 22).

It is also important to note that Furtado had lost his civil rights and had to leave Brazil following the military coup in 1964. For him, the lack of democracy, not only in Brazil, but in Latin America as a whole, is important to explain the region underdevelopment. The fact that he lost his civil rights is an important fact to explain why he may have adopted the idea that the lack of freedom is a blockage to creativity.

Furtado changes his perspective about the underdevelopment problem when compared 1961 and 1978's books. Cunha and Britto (2011) bring a few reasons for this perspective change, as follows:

- i) Furtado says (in his autobiography) that he had a linear path to build his economic development theory. Just like a natural path towards his ideas evolution. Cunha and Britto (2011) challenge this view, because Furtado could not know he would come up with the ideas present in the 1978' book;
- ii) Furtado struggles to find a new theory that could be a counterpoint to neoclassical theory. Thus, “Furtado’s intellectual path is not the sustained rate of progress of a set of ideas and concepts, but rather a permanent intellectual struggle with the narrow horizon of mainstream economics to encompass all the issues, as well as their interrelations, involved with underdevelopment and development proper.”(p.19);
- iii) A few seminars that Furtado organized in 1964 in Chile after having hereby lost his civil rights in Brazil. In this seminar the author discussed with other intellectuals the ECLA' texts, where reflections on the subject of culture and dependence emerged;

- iv) A further possible explanation was Furtado second stay at Cambridge University in the 70's, where he attended numerous seminars of discussions on subject of economic growth and development.

It is argued that in the 1961' book, Furtado interpretation regarding technology and therefore productivity was related to the Keynesian model. Adding to this, for him the technology could be increased if there is an increase in saving level, which would increase investment and thus productivity. In this model, savings are preceding to investment. And there is the productivity issue, which dismisses the workforce, making the development process difficult. Furtado's interpretation was challenged by two authors in the book "*Dependência e Desenvolvimento na América Latina- ensaio de interpretação sociológica*" (Dependency and Development in Latin America- a sociological interpretation) written by Fernando Henrique Cardoso and Enzo Faletto. This book was written in the middle of military dictatorship in Brazil, and it makes an interpretation of the underdevelopment and dependency process in Latin America from a Marxist perspective. It is interpreted that this criticism made by Fernando Henrique Cardoso and Enzo Falletto was one of the important factors for the change in Furtado' approach to underdevelopment, and therefore on technological progress.

Furtado (1978) argues that economic agents impose their own will, whether consciously or unconsciously, over the economic system. So, with the creativity advent, it is achieved an implicit element of power. For him, creativity breaks the macroeconomics/microeconomics logics in the sense which it gives to the agent power of transformation. Thus, the meaning of creativity is closed to the innovation concept.

Innovation, hence technical progress, is one of the spheres where human creativity emerges. Innovation is treated on various aspects along 1978's work. He discusses innovation in many dimensions, such as social, cultural, economic and also political (ALBUQUERQUE, 2013). For instance, on the nation and companies subject, the State and large companies have dominant position in initiatives focused on capital accumulation and creativity. And it is at the international level that the innovative capacity of industrial capitalism shows just how much can be creative, and generate innovation.

Other interesting aspect related to creativity, it is referred to industrialization process. Innovations in the productive methods become the fastest path to overcome and competition, using the notion that creativity or innovation is an instrument of power. Thus, the increase of productive excess no longer depends on the trade opening of the markets. The accumulation process depends on the creativity. Thus, the acceleration process of capital accumulation is necessarily an innovative activity.

To Albuquerque (2013), the industrial society is a constraint to human creativity. In this sense, due to the need of industrial society, the scientific creation becomes subordinate to technical innovation, and this technological creation becomes directed to the conveniences of the accumulation process. Therefore the industrial civilization constraints creativity, because the instrumental logic. This aspect may be understood as Furtado criticizes the capitalist society. It is clear that capital accumulation no longer depends on savings rate, as in previous Furtado' books (more specifically, in the 1961' book). On the opposite, capital accumulation is the vector which permits, through innovation, to introduce changes in the production system, and on social structures (FURTADO, 1978, p. 480). In his view, in dependent countries, innovations are not produced.

In addition to the discussion about innovation, capital accumulation in relation to nations and companies, Furtado emphasizes that innovation in the consumption sphere allows the consumption diversification for the population majority. To him, the interdependence between individual consumption stimulus and innovations flow is the stimulates to accumulation. It is what he calls “industrial civilization”, which tends to keep society split into classes of consumption patterns.

The capital accumulation releases resource to create new needs, which stimulates new inventions. In this case, scientific research was increasing in the historical process. The scientific research was put into the service of technical innovation that seeks for greater efficiency of human labour and diversification of consumption patterns.

Furtado clearly changes his opinion about factors that stimulate labour productivity. Earlier in the 1961' book, productivity would increase by an increase of machines with higher technological content, which would also increase in the presence of investments, therefore higher levels of savings. In the 1978' book, scientific research is treated in Schumpeterian terms, more specifically investment in R&D, which increases the technology content and consequently the efficiency of the technique and labour productivity.

The capital accumulation process has two main pillars: i) innovation that enables to differentiate consumers, and ii) the innovation diffusion that homogenizes the consumption forms. The consumer has a passive role that consists of answering to the stimulus to which he is submitted. Innovations encourage a higher spending level, which differentiates consumers. The consumption pattern is in the beginning restricted to some consumers. Afterwards, it will be overcome and diffused, which allows the market to expand in all dimensions. Economic growth and capital accumulation will be directly linked to creativity.

The aim of this section was to explain that the context where Furtado was inserted was important for the changes observed in his theories regarding to the determinants of technological progress, innovation and productivity. Furthermore, it is considered important to observe that this evolution is part of Furtado's own intellectual trajectory. Adding to this, there is the issue about the criticism from Fernando Henrique Cardoso and Enzo Faletto.

## **5- Final considerations**

This paper aimed to discuss the differences of the technical progress determinants, therefore, productivity and economic growth in Celso Furtado's work. In the second section of this project, the aim was to study the first chapter of Furtado 1961' book in order to verify the criticism that he made to the classic authors of economic thought, namely Keynes and Schumpeter. This study provided us with a basis for understanding his interpretation on technological progress determinants, consequently productivity and economic growth. Furtado criticized the classical economists because he saw there was not space (in the classical thinking) for economic development discussion. He also criticized the Keynesian approach and proposed some changes. In his proposed changes, the distribution of income becomes important into the Keynesian model. Furtado (1961) argues that innovation in Schumpeter's theory is not a theory about innovation, but a theory about organization or a new combination of enforces of production. Thus, what matters is the monopoly that emerges from a new way of organizing production.

In the third section it was discussed Furtado's view on technical progress determinants and which theory he used for his economic analysis. It is argued that Furtado, at least partially, uses the Harrod-Domar model to analyse the underdevelopment. Technological

progress would be achieved by increasing investment and domestic savings. However, domestic savings does not increase because of income concentration in Brazil (and in underdevelopment nations in general), which makes it impossible for workers to increase savings.

The fourth section is analysed the technical progress determinants 1978' book. It is argued that Furtado changed his theory about the technical progress determinant. Specifically, in the 1978' book, creativity is responsible for bringing innovations, and innovation generates technical progress, consequently economic growth. This book in the context it was written, reflects three different issues: i) the Marxist criticism made by Fernando Henrique Cardoso and Enzo Faletto; ii) the intellectual context in which Furtado was immersed, specifically at the University of Paris; iii) the issue of the dictatorship in Latin America (specially the claim that the lack of freedom is a constraint to the creativity).

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